

Journal of the Royal Society of Arts

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VOL. CIV

FORTHCOMING MEETINGS

MONDAY, 14TH MAY, at 6 p.m. The second of three CANTOR LECTURES on '*Some Recent Studies of Sociology*', entitled '*Some Aspects of the Development of Demography*', by David V. Glass, B.Sc.(Econ.), Ph.D., Professor of Sociology, University of London at the London School of Economics.

WEDNESDAY, 16TH MAY, at 2.30 p.m. PETER LE NEVE FOSTER LECTURE. '*Electronic Photography*', by C. G. Mayer, O.B.E., M.I.E.E., of the Radio Corporation of America. Sir Harold Bishop, C.B.E., F.C.G.I., M.I.E.E., M.I.Mech.E., Director of Technical Services, British Broadcasting Corporation, will preside. (The lecture will be illustrated with demonstrations and lantern slides.)

MONDAY, 28TH MAY, at 6 p.m. The last of three CANTOR LECTURES on '*Some Recent Studies of Sociology*', entitled '*Changes in Social Responsibilities*', by Roger F. Tredgold, M.A., M.D.

TUESDAY, 29TH MAY, at 5.15 p.m. COMMONWEALTH SECTION. NEIL MATHESON MCWHARRIE LECTURE. '*The Theatre and Ballet in Canada*', by Robert Speaight, M.A., F.R.S.L. His Excellency Mr. Norman A. Robertson, High Commissioner for Canada, will preside. (Tea will be served from 4.30 p.m.)

WEDNESDAY, 30TH MAY, at 2.30 p.m. '*Examinations : Do We Still Need Them?*' by Sir Griffith Williams, K.B.E., C.B., a Member of the Council of the Society, and former Deputy Secretary, Ministry of Education. Sir Edward Crowe, K.C.M.G., a Vice-President of the Society and Chairman of its Examinations Committee, will preside.

WEDNESDAY, 6TH JUNE, at 2.30 p.m. '*The Influence of National Character on Design*', by Paul Reilly, Deputy Director, Council of Industrial Design. John Gloag, Hon.A.R.I.B.A., a Member of Council of the Society, will preside. (The paper will be illustrated with lantern slides.)

Fellows are entitled to attend any of the Society's meetings without tickets (except where otherwise stated), and may also bring two guests. When they cannot accompany their guests, Fellows may give them special passes, books of which can be obtained on application to the Secretary.

INDUSTRIAL ART BURSARIES EXHIBITION

The Exhibition of winning and commended designs submitted in the 1955 Industrial Art Bursaries Competition was opened in the Library by the Right Honble. Sir David Eccles, K.C.V.O., M.P., Minister of Education, on Wednesday, 2nd May.

There was a large audience which consisted of those directly concerned with the work of the Competition and included a number of Principals of Schools and members of the industries which subscribed towards the awards.

SIR ERNEST GOODALE, the Chairman of the Industrial Art Bursaries Board, and a Vice-President of the Society, in introducing the Minister, pointed out that the Competition, which was revived after the war, was now firmly established. Referring to the objects of the Competition, as set out in the Report, Sir Ernest spoke of the Council's hope that the broader purpose of encouraging students to turn to industrial designing for a career, rather than to art teaching, would also be fostered. In this way the Society's early awards of premiums in different branches of commerce were carried on.

In thanking the various individuals and bodies who supported the Competition financially, and those eminent ladies and gentlemen who had so generously given their time on the Juries, Sir Ernest referred to the fact that the latter looked for signs of promise rather than of present accomplishment, although the method of presentation had much improved over the years. The reports on their tours submitted by the students, several of which were on display, were frequently most competently presented and illustrated. The interest shown in the Exhibition, which was this year to be shown not only in some provincial cities but also at The Production Exhibition at Olympia, was noteworthy.

Referring to the new sections to be included in the 1956 Competition, Sir Ernest welcomed the return of those for domestic glassware and pottery, and the introduction of a new section for the design of cinema and television settings. He also mentioned that additional Bursaries were being offered, thanks to the generosity of Sir Herman Lebus and Mr. George Minter.

In conclusion, Sir Ernest spoke of the Society's gratitude for the interest shown in the Competition by the Ministry of Education, which was clearly indicated by the Minister himself having graciously consented to open the Exhibition, and this Sir Ernest then invited him to do.

THE MINISTER said:

It is very kind of the Royal Society of Arts to give me the chance to come and congratulate them on this new round of their Competition. I have always been intensely interested in design. I had a chance at the Ministry of Works to do something on a practical scale and nobody helped us more than Sir Ernest Goodale himself. I can assure you that many times in the preparations for the Coronation, when we rushed off to get him and said 'well, what about it', he was always there with his advice, which was so helpful, and I think with such a fine taste in everything.

I really come from the agricultural industry which is the wisest, the oldest industry in the country. We have certainly had shows for cattle and pigs and

sheep from time immemorial. It is very good for the animals and it is very good for the farmers. I think that it is the same with this sort of show—it is very good for the designers and for the industrialists, and I hope that the idea will spread. I was very interested to hear the chairman say that the industrialists put up by far the larger part of the money. That is good, and it does show that business men, who are always supposed to look for results, think it is worth while risking their shareholders' money—it is not theirs, of course, it is their shareholders'—in these prizes. This must be of great satisfaction to Sir Gordon Russell who sometimes laments a little, I think, at the slow way business takes up design. Anyway, he can feel—I see him there—that here is one small proof that they are waking up.

You said, Mr. Chairman, that you thought that it was a good thing for students to go off into industry and for not too many of them to teach. I agree with that up to a point, but what I really wish to see is a two-way street between industry and teaching. I think we have invented a thing called the 'sandwich course', which means that the student goes for six months to a technical college and then for six months to industry, and so on perhaps for four or five years—six months in each. What I must find is some 'sandwich' professors! Industry must help me. I want the people who teach to have a closer contact with the manufacturer and industry generally. Industry has been generous in lending us teachers, but perhaps we can go a little bit further. I am not at all sure that that sort of life does not rather suit the British people, being partly academic and partly practical. Anyway I am going to pursue this plan and I hope you will help me.

From time to time some branch of industry comes to the Ministry and asks whether they can run a design competition of their own. Well, of course, far better a competition on their own than none at all. We all agree about that, but I think it would be better still if they would come in under the umbrella of the Royal Society of Arts, because I think a collection of exhibits, of works of art at any rate, has a value beyond that of the individual exhibits. This is particularly true when the artists are not well known. If you can get a show going together with others, then it enables you to exchange ideas and to make new contacts. On the whole therefore, I would say to industries who are thinking about setting up competitions, first of all, at any rate, give thought to joining the list of Bursaries here.

I was glad to see that there are some more on your list this year and especially that the women's fashions have flourished. It must be a great source of pleasure to have the Bianca Mosca scholarships inside this scheme. I have to admit that when I was younger and richer I often went to a dress show. I do not think there is any pleasure in the world equal to buying a dress for someone who, at any rate for the first time, will wear it in your company. Those are old days which I have almost forgotten.

I would like to join with Sir Ernest and thank all the Juries—they have evidently taken very great trouble and those short reports which are printed in the Report seem to me to be of great value and interest both to the visitors who come to look and, I should also say, to the students themselves. We want cross fertilization between one type of designer and another. I looked at the names of the members of the Juries and saw that there were some friends of mine there—Sir Francis Meynell, for example. I saw him in a new rôle for I know that he is a master at printing a book, but he seems to be an expert at poking the fire as well! Anyhow he takes everything in his stride and I am sure that he is very typical of the quality of the Juries. I think that a Royal Designer for Industry is to be found on every one. That is a wonderful thing that the Royal Society of Arts did in starting the Faculty of Royal Designers for

Industry—it must have raised the status of the designer a great deal. It made a lot of people conscious of design who, perhaps, had not thought of it before.

It only remains to me to congratulate the winners. I hope they will have a good trip abroad if they go. I think it is Mr. Jacobs who looks after the arrangements for these trips—they are very well arranged. I have had just a little look at one or two of the reports here—they ought to go, I suppose, to the British Museum as social documents. They look splendid. I am sorry for those who are runners-up. It is rather bad luck if you are so near the money and not quite there, but they will, perhaps, have better luck next time. I hope they will go in again, if that is allowed by the rules of the Competition.

I think we have to be publicity agents for designing; we have all got to shout it out from the roof-tops. I was particularly interested when we were talking to the Russians the other day. You will notice that almost the last sentence of the *communiqué* after the Russian visit broke new ground; it said that the Russians were interested in the import of consumer goods. That is new ground, and highly significant. What exactly they meant I do not know, but I hope they meant dresses for their girls, and I have a suspicion that would be a pretty good market. Anyway the point is we are going to be able to break into this great new market behind the Iron Curtain with a trickle, at any rate, of consumer goods. We cannot tell what this might mean: certainly our designs will carry there a message of great importance. Let us all keep up the cry for good designing. The walls of Birmingham or Jericho—or wherever it is—are falling down—and you are getting in.

I therefore have the greatest pleasure in opening this Exhibition.

DR. R. W. HOLLAND (Chairman of the Council of the Society) in thanking the Minister pointed out how appropriate it was that the Minister of Education should open the Exhibition. What was more, he had as Minister of Works been responsible for the Coronation arrangements and had also been for a time during the war at the Ministry of Production, the connection between design and production being self evident. In concluding, Dr. Holland expressed the Society's great appreciation of the kindness of a busy Minister in opening the Exhibition, and of the confirmation which this provided of the importance of its subject.

After the opening of the Exhibition, Sir David Eccles was entertained at luncheon at the Savoy Hotel by members of the Council of the Society.

As already announced, the Exhibition will remain open at the Society's House until Friday, 18th May: from 10 a.m. to 5.30 p.m. on Mondays to Fridays, and from 10 a.m. to 12.30 p.m. on Saturdays.

PUBLICATION OF 1955 COMPETITION REPORT

The Report on the 1955 Industrial Art Bursaries Competition has now been published, and copies may be obtained from the Deputy Secretary without charge.

In addition to the list of awards, which was published in the *Journal* on 2nd March last, the Report also contains particulars of the Tests set in each section, the reports and compositions of the Juries, and a summary of the uses made of Bursaries in 1955 by previous Bursary winners. Illustrations of most

of the winning designs, a number of which were reproduced in the *Journal* on 2nd March last, are also included in the Report.

INDUSTRIAL ART BURSARIES COMPETITION, 1956

The Report on the 1955 Competition referred to above contains the particulars of the Competition to be held in 1956. The following sections will be included and, except where otherwise stated, one Bursary of £150 will be offered in each:

DOMESTIC ELECTRICAL APPLIANCES	ACRYLIC SHEET ("PERSPEX")
ELECTRIC LIGHT FITTINGS	LAMINATED PLASTICS
DOMESTIC SOLID-FUEL-BURNING	P.V.C. PLASTICS SHEETING
APPLIANCES	CINEMA AND TELEVISION SETTINGS
CARPETS	DOMESTIC GLASSWARE
DRESS TEXTILES (TWO BURSARIES)	FOOTWEAR
FURNISHING TEXTILES	FURNITURE (THREE BURSARIES)
WOMEN'S FASHION WEAR (TWO BURSARIES)	JEWELLERY
MOSCA AWARDS OF £200 AND £150	POTTERY
RESPECTIVELY)	WALL-PAPER

In addition to the above Bursaries the Council of the Society may provide supplementary awards from the Art Congress Studentship Trust Fund and from the Owen Jones Memorial Trust Fund.

Subject to certain conditions, successful candidates will be offered Associate Membership of the Society.

The Sir Frank Warner Memorial Medal will be awarded to the candidate submitting the best design in the Set Test in either the Furnishing Textiles, Dress Textiles, or Carpet sections of the Competition, if of sufficient merit. This Medal may be awarded to a successful candidate in addition to a Bursary.

The last day for the receipt of entry forms is 15th October, 1956.

THE SOCIETY'S CHRISTMAS CARD, 1956

With the object of providing as long notice as possible to overseas Fellows, so that they may be able to place their orders in good time, this preliminary announcement is given of the card which the Society will produce for the use of its Fellows for Christmas 1956.

In view of the recent celebrations of the 250th Anniversary of the birth of Benjamin Franklin and the approaching Bicentenary of his election to membership of the Society of Arts on 1st September, 1756, it seemed appropriate that the card should this year celebrate the association of Franklin with the Society. The subject which has been chosen is his attendance at a meeting, on 3rd February, 1759, of the Committee responsible for the adjudication of the

entries for the Society's art competitions. The records of this meeting are complete to the extent not only of giving the names of the members of the Society who assisted with the judging, but also the names of the candidates who were interviewed and, in a number of cases, the actual drawings.

The Society is fortunate in again having persuaded Miss Anna Zinkeisen, R.O.I., R.D.I., to reconstruct the scene and her painting will be reproduced in full colour.

An illustration of the Christmas card will be published in the *Journal* in due course, and in the meantime it would be of assistance if Fellows resident in places abroad to which surface mails from this country are slow, would indicate their requirements to the Secretary. Owing to increased printing costs it is expected that the charges will be slightly, but not much, higher than last year, when they were 11s. 6d. a dozen for overseas members and 14s. a dozen for home members. Overprinting of the name and address can be undertaken at an extra charge. Full details of prices will be announced as soon as possible, and it is hoped that the cards themselves will be ready for despatch by the end of September.

INSTITUTIONS IN UNION

Under the Society's Bye-Laws the Council may admit into union any body or organization whose objects are similar to those of the Society, namely, the encouragement of arts, manufactures or commerce. This wide definition embraces literary and scientific institutions, libraries, universities, schools, colleges and the like, and it is the Council's desire that the number of these Institutions in Union should be increased. The privileges attaching thereto are much the same as those of individual Fellowship, and include, for an annual subscription of £3 3s. *od.*, the receipt of the fortnightly *Journal* and the right of an appointed representative to use the library and to attend meetings.

It is possible that many Fellows may be connected with, or be aware of, eligible organizations which might benefit as a result of associating with the Society in this way, and fuller details of the scheme will gladly be sent on request either to Fellows or direct to bodies suggested.

THE ARITHMETIC OF THE MUSICAL SCALE

A paper by

*L. H. BEDFORD, O.B.E., M.A., B.Sc., M.I.E.E.,
of the English Electric Co., Ltd., read to the
Society on Wednesday, 15th February, 1956, with
W. Greenhouse Allt, Mus.D., Principal, Trinity
College of Music, and a Member of Council of the
Society, in the Chair*

THE CHAIRMAN: The title of this paper interests me as a musician, but arithmetic always daunts me. However, I know Mr. Bedford to be one of those rare birds, a highly skilled physicist who is also a musician; a musician because he loves music and is surrounded by a music family. His father, mother, and grandmother, his wife and his three children are all musicians, which should be enough to lift him from the solid earth of physics into the realm of music.

If these are controversial matters in his paper it may be unwise to cross swords with him in argument, because in everyday life he is a Chief Engineer of Guided Weapons!

The following paper, which was illustrated with musical and physical demonstrations, was then read:

THE PAPER

INTRODUCTION

About the year 500 B.C., Pythagoras gave a clear arithmetical basis to the musical scale. In 1885 Ellis and Hipkin¹ were able to collect and tabulate on a numerical basis some 130 musical scales from all sources. From 1850 onwards the Even Tempered scale for keyed instruments gained ascendancy over all previous temperaments, a situation which has become so far consolidated² that scarcely any living person has had the opportunity of hearing anything else. In these circumstances, it may well be asked what more remains to be said and what justification exists for a paper of the present title? To this highly reasonable question, one may offer the following answers:

First the universal adoption of Even Temper has not only thrown into oblivion the beautiful arithmetical patterns which underlie the earlier temperaments but has also brought about the situation that such temperaments can never be heard. The present paper, with its essential component of musical demonstrations, endeavours to correct this situation.

More importantly, however, a new issue comes up for consideration arising from the interesting impact of a new subject on one some hundred times its age, that of electronics on music. With the introduction of electronic musical instruments, especially the electronic organ, still in its infancy (and of suspected illegitimacy), we are for the first time in history unfettered from the restriction

of a fixed temperament. The implications of this remain to be assessed, but should imply a revival of interest in the subject of scales and temperaments.

PHYSICO—MUSICAL PREAMBLE

In approaching a subject which is essentially common ground to the musician and the physicist, one is faced with the problem that they lack any commonality of language and even of ideas. It is, therefore, the purpose of this introduction to present some common approach, and the writer believes that this must be framed largely in the language of physics. Therefore, at the risk of banality, one must commence with the statement that 'sound' is essentially an oscillatory fluctuation of air pressure for which the ear and brain provide an incredibly elaborate receptor and interpretive mechanism. As a special category of sound, one may classify as 'musical' those sounds which are essentially cyclic in character, that is the pressure fluctuation repeats at regular time intervals. The number of complete cycles occurring per second is called the *frequency*.

For analytical purposes one particularly important form of oscillation focusses attention, that of the simplest form of oscillatory system comprising one stiffness and one inertia, for example a mass on the end of a spring; this oscillation is termed sinusoidal. More complex sounds can be expressed as a combination of sinusoids, and in musical tones the frequencies of these are integrally related. This corresponds with the fact that musical vibrators such as strings and pipes have oscillatory modes thus integrally related in frequency; whereas in non-musical sounds (gongs, drums, and so on) the frequency ratios are definite but not integral.

From a musical point of view, the most important characteristic of a tone is its pitch, and this is found to be associated very directly with its frequency, namely the number of cycles (of pressure fluctuation) per second. The question immediately arises with what range of frequencies and with what amplitudes of pressure fluctuation are we concerned? This is answered somewhat comprehensively by the diagram of Figure 1, which indicates primarily the characteristics of the human ear. Because of the wide spread of hearing characteristics between individuals, a statistical presentation is adopted². The lower three curves are minimum audibility levels for various grades of ear. The lowest curve is for a sensitive ear; the designation ten per cent meaning that only ten per cent of the population can hear tones which are quieter than the values plotted. The fifty per cent curve represents the characteristic of an average ear, and that above it is for an insensitive ear; ninety per cent of the people can hear better than this. The uppermost curve is called the threshold of feeling; it specifies the level at which the sound intensity is so high as to be classed as pain.

Figure 1 includes more information than is required for our immediate purposes, but, concentrating on general features, we may note the peaking of aural sensitivity in the region of three thousand c/s with low frequency cut-off in the region of thirty c/s and a high frequency cut-off in the region of ten K c/s. A fact not disclosed by the diagram is the major dependence of this latter quantity

on age group. The correlation between the musical term pitch and the physical term frequency is shown at the bottom of the diagram, and it is to be noted that music exploits substantially the whole frequency range of the human ear. The vertical scales, five in number, are also of note:

Scale 1 is the conventional representation of pressure (fluctuation) in dynes per cm^2 .

Scale 2 shows the same information on a barometric scale, in which the unit 'one bar' is normal atmospheric pressure. It is seen then that a pressure fluctuation of amplitude $1/5,000$ atmosphere takes us to the threshold of feeling. Normal musical levels are vastly smaller.

Scale 3 expresses the matter on a power basis, watts per metre²; and having regard to the small collecting area of the ear one sees what an extremely sensitive receiver is here involved.

Scale 4 expresses relative power on the usual decibel scale.

Scale 5 is an attempt to correlate all the above with the musicians' scale of loudness, ppp to fff. Only the roughest interpretation can be placed on these

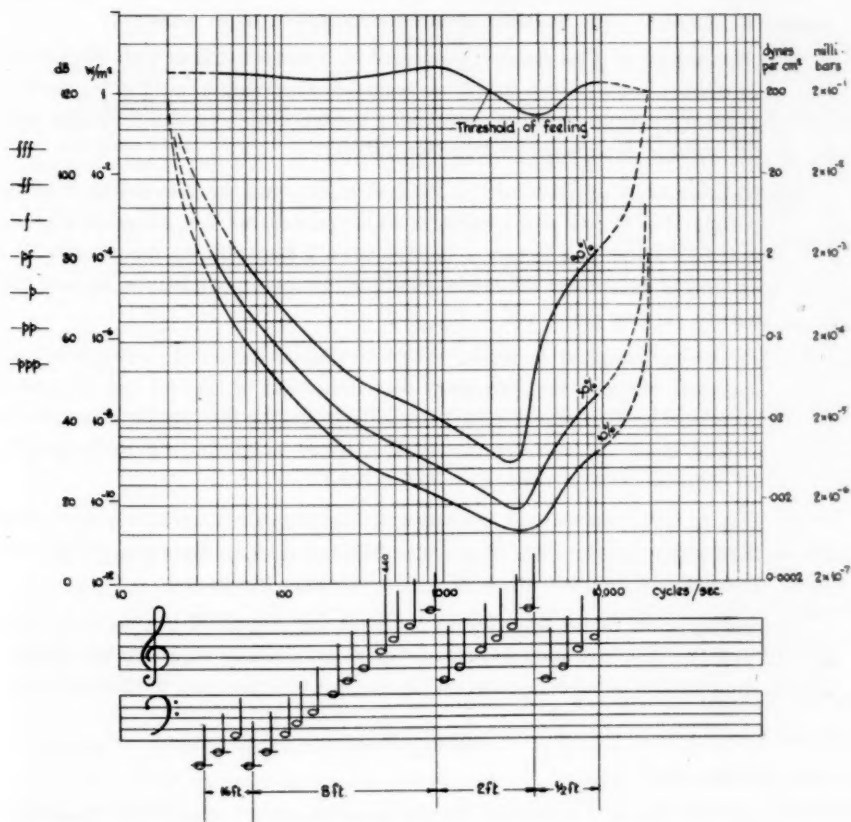


FIGURE 1

figures which relate to orchestral studio conditions. (Courtesy of B.B.C. Research Dept.). The tremendous range of amplitudes involved is to be noted. This fact is one of the problems of the communication engineer and the nightmare of the recordist.

Figure 1 may be brought to life by way of demonstrations. In these we make extensive use of 'transducers'. By this term is meant an instrument which receives a signal input in one form and yields a signal output in another, for example:

1. Microphone, which might be termed an 'AC transducing barometer'.
2. Loudspeaker. An AC transducing wattmeter.
3. Cathode ray oscilloscope. The transduction is here voltage into displacement of a visible spot. (*A musical demonstration was then given.*)

The above preamble and demonstrations it is hoped will answer the questions which the musician frequently asks when the physics of music is discussed, namely 'frequency?' and 'frequency of what?'

We come now to the question, with what accuracy of frequency are we concerned in music? This question seems to demand a triple answer:

- (a) *Absolute pitch.* This faculty, possessed by a minority, is of little importance in music; but a person would be regarded as having a fairly good absolute pitch if he could identify a frequency to an accuracy of about five per cent. (*A musical demonstration was then given.*)
- (b) *Relative pitch.* This faculty is basic in music, and we may say that for the comparison of two tones adjacent in frequency but not sounded together a sensitive ear can detect a change of 0.1 per cent in frequency. This statement is subject to some qualification as to conditions of test and nature of tone involved.
- (c) *Pitch discrimination by beats.* When two tones adjacent in frequency are sounded together the frequency discrimination of the ear can be greatly increased by its sensitivity to 'beats'. Beats are the fluctuation of amplitude arising from the interference of two tones neighbouring in frequency. (*A musical demonstration was then given.*)

It is to be noted that the existence of beats does not involve any pressure fluctuation at the beat frequency, but rather a modulation at the beat frequency of the amplitude of a tone of higher frequency.

The ear appears to be sensitive to beats in the region of 0.5 to 10 c/s per second and the fact that such beat frequencies are usually regarded as disagreeable is the basis for most argument on the subject of scales and temperaments.

MUSICAL SCALES

The 'Just Diatonic' scale

Having established a sufficient degree of correlation between the musician's term pitch and the physicist's term frequency, it will now be convenient to

adopt a somewhat dogmatic approach to the subject of scales by writing down a particularly important scale, the 'Just Diatonic', as a series of frequency ratios:

$$1 \quad 1\frac{1}{8} \quad 1\frac{1}{4} \quad 1\frac{1}{3} \quad 1\frac{1}{2} \quad 1\frac{2}{3} \quad 1\frac{7}{8} \quad (2)$$

What is the magic in this particular sequence of numbers that has allowed it to become the basis of Western music for the last many centuries? This question is a difficult one to answer with any degree of conviction. First, we may note that it is made up of relatively simple ratios, that is to say fractions represented by quotients of fairly small integers. The consonant nature of frequencies related by such simple ratios has long been recognized. The basis for this has been emphasized by Helmholtz, namely that such relationships secure the absence of disagreeable beats between the (integrally related) overtones; but (a) this scale greatly pre-dates the conception of harmonic music, and (b) the basis for the selection of certain simple ratios and the rejection of others is not clear. Table I shows the details of this selection, the absent ratios being denoted by crosses. The selected ratios are shown with reference to a keynote chosen as 'C'. Repeated selections or rejections are shown in brackets.

TABLE I

Numerator															
Denominator	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	C	—	—	—	—										
2	—	(C)	G	—	—										
3	—	—	(C)	F	A										
4	—	—	—	(C)	E	(G)	X	—	—	—	—	—	—	—	—
5	—	—	—	—	(C)	X	X	X	—	—	—	—	—	—	—
6	—	—	—	—	—	(C)	X	(E)	(G)	(A)	X	—	—	—	—
7	—	—	—	—	—	—	(C)	X	X	X	X	X	X	—	—
8	—	—	—	—	—	—	—	(C)	D	(E)	X	(G)	X	(X)	B

The number of possible rational fractions $\frac{m}{n}$ with $1 < \frac{m}{n} < 2$ and with $n \leq 8$ is 21 of which only seven are chosen to constitute the scale. Apart from the presence of all fractions with denominators up to four and the total absence of fractions with denominators five, six and seven, it is difficult to discern any clear pattern in the scheme.

A more revealing approach may be made along the lines of Pythagoras who appears to have regarded the 'perfect fifth' or frequency ratio $\frac{3}{2}$ as the dominant interval. (The musical term dominant possibly derives from this rather than from the modal use of the term.) If we 'unfold' the scale in a sequence of nominal fifths we obtain the sequence of Table II (left-hand main column).

TABLE II

	Just Diatonic				Pythagorian Lydian				Ancient Lydian			
F	$\frac{4}{3}$	$\frac{2}{3}$			$\frac{4}{3}$	$\frac{2}{3}$			$\frac{4}{3}$	$\frac{2}{3}$		
C	1	1			1	1			1	1		
G	$\frac{3}{2}$	$\frac{3}{2}$			$\frac{3}{2}$	$\frac{3}{2}$			$\frac{3}{2}$	$\frac{3}{2}$		
D	$\frac{9}{8}$	$\frac{9}{4}$			$\frac{9}{8}$	$\frac{9}{4}$			$\frac{10}{9}$	$\frac{20}{9}$		
A	$\frac{5}{3}$	$\frac{10}{3}$			$\frac{27}{16}$	$\frac{27}{8}$			$\frac{5}{3}$	$\frac{10}{3}$		
E	$\frac{5}{4}$	5			$\frac{81}{64}$	$\frac{81}{16}$			$\frac{5}{4}$	5		
B	$\frac{15}{8}$	$\frac{15}{2}$			$\frac{243}{256}$	$\frac{243}{32}$			$\frac{15}{8}$	$\frac{15}{2}$		

We see that with one exception all of the intervals are exactly $\frac{3}{2}$; the exceptional interval, D to A, is $\frac{40}{27}$ or $\frac{3}{2} \times \frac{80}{81}$. This last factor is one of the well-known 'commas' of the subject, the comma of Didymus. The same comma applied in different places gives rise to two earlier versions of the diatonic scale, namely the Ancient Lydian and the Pythagorean Lydian. The three scales differ only in the selection of which particular fifth is 'adjusted'. That some such adjustment is inevitable follows in general terms from the fact that no integral power of $\frac{3}{2}$ is an integral power of 2.

Whilst the above shows the arithmetic of the Diatonic scales it does not make it clear what peculiar merit has allowed them, or one in particular, to become the basis for so wide a range of music to the exclusion of so many other possibilities. To cite only a part of the range covered, we may mention Bach, Beethoven, Brahms, Britten, and the butcher's boy on his bicycle. The last is added not only for alliteration but to suggest that there is something about this form of scale which 'comes naturally'. But if this is so the arithmetic fails to reveal it.

Transposing properties of the 'Just Diatonic' scale

The problem of transposition arises only in connection with keyed instruments where a limited number of notes are admissible. The problem is to explore how many notes of a scale, based on a particular keynote, can be used as notes of the same scale based on another keynote. A very simple example will reveal the problem. Consider the scale

C	D	E	F	G	A	B
<u>1</u>	9/8	5/4	4/3	3/2	5/3	15/8

and let us construct the same scale starting on G as a keynote. This simply means that all frequencies are to be multiplied by the ratio of $\frac{3}{2}$ and divided by two where necessary to bring them within the octave. We reach

C	D	E	F	G	A	B
<u>1</u>	9/8	5/4	45/32	<u>3/2</u>	27/16	15/8

We find that of the seven notes of the original scale, five recur in the new scale and two new notes are involved, namely (A, $\frac{5}{3}$) becomes (A, $\frac{27}{16}$), a sharpening in the ratio of $\frac{81}{80}$ and instead of (F, $\frac{4}{3}$) we get a new note at $\frac{45}{32}$, a sharpening of the F in the ratio $\frac{135}{128}$. The new note is, of course, the F# of the scale of G.

Table III shows the complete scheme of transposition taking six keys sharp and flat on either side of C. Such a table is more interesting to construct than to read, but from it (or from the previous argument) we may deduce the general rule as follows: for each move into the next sharper key the second note of the scale requires sharpening in the ratio $\frac{81}{80}$ and the seventh note (leading note)

TABLE III

Keynote → Scale note	G♭	D♭	A♭	E♭	B♭	F	C	G	D	A	E	B	F♯
C		$\frac{80}{81}$	$\frac{80}{81}$	1	1	1	$\frac{1}{1}$	1					
	$\frac{256}{243}$	$\frac{256}{243}$	$\frac{256}{243}$						$\frac{135}{128}$	$\frac{135}{128}$	$\frac{135}{128}$	$\frac{2187}{2048}$	$\frac{2187}{2048}$
D				$\frac{10}{9}$	$\frac{10}{9}$	$\frac{10}{9}$	$\frac{9}{8}$	$\frac{9}{8}$	$\frac{9}{8}$	$\frac{9}{8}$			
	$\frac{2560}{2187}$	$\frac{32}{27}$	$\frac{32}{27}$	$\frac{32}{27}$	$\frac{32}{27}$					$\frac{1215}{1024}$	$\frac{1215}{1024}$	$\frac{1215}{1024}$	$\frac{1215}{1024}$
E						$\frac{5}{4}$	$\frac{5}{4}$	$\frac{5}{4}$	$\frac{81}{64}$	$\frac{81}{64}$	$\frac{81}{64}$	$\frac{81}{64}$	
F	$\frac{320}{243}$	$\frac{320}{243}$	$\frac{320}{243}$	$\frac{4}{3}$	$\frac{4}{3}$	$\frac{4}{3}$	$\frac{4}{3}$						$\frac{10935}{8192}$
	$\frac{1024}{729}$	$\frac{1024}{729}$						$\frac{45}{32}$	$\frac{45}{32}$	$\frac{45}{32}$	$\frac{729}{512}$	$\frac{729}{512}$	$\frac{729}{512}$
G			$\frac{40}{27}$	$\frac{40}{27}$	$\frac{40}{27}$	$\frac{3}{2}$	$\frac{3}{2}$	$\frac{3}{2}$	$\frac{3}{2}$				
	$\frac{128}{81}$	$\frac{128}{81}$	$\frac{128}{81}$	$\frac{128}{81}$						$\frac{405}{256}$	$\frac{405}{256}$	$\frac{405}{256}$	$\frac{6561}{4096}$
A					$\frac{5}{3}$	$\frac{5}{3}$	$\frac{5}{3}$	$\frac{27}{16}$	$\frac{27}{16}$	$\frac{27}{16}$	$\frac{27}{16}$		
	$\frac{1280}{729}$	$\frac{1280}{729}$	$\frac{16}{9}$	$\frac{16}{9}$	$\frac{16}{9}$	$\frac{16}{9}$						$\frac{3645}{2048}$	$\frac{3645}{2048}$
B	$\frac{4096}{2187}$						$\frac{15}{8}$	$\frac{15}{8}$	$\frac{15}{8}$	$\frac{243}{128}$	$\frac{243}{128}$	$\frac{243}{128}$	$\frac{243}{128}$

TABLE IV

	G♭	D♭	A♭	E♭	B♭	F	C	G	D	A	E	B	F♯
1	C	987654	987654	1	1	1	1	1	1				
1-059403		1-053408	1-053408						1-054088	1-054088	1-054088	1-087871	1-087871
1-122462	D			1-111111	1-111111	1-111111	1-125	1-125	1-125	1-125			
1-180207		1-170553	1-185185	1-185185	1-105185						1-180523	1-180523	1-180523
1-250021	E					1-25	1-25	1-25	1-205625	1-205625	1-205625	1-205625	
1-334840	F	1-316872	1-316872	1-333333	1-333333	1-333333	1-333333						1-334839
1-141214		1-404604	1-404604					1-400250	1-400250	1-400250	1-423828	1-423828	1-423828
1-408207	G		1-481481	1-481481	1-481481	1-5	1-5	1-5	1-5				
1-587401		1-580247	1-580247	1-580247						1-582031	1-582031	1-582031	1-601807
1-681793	A				1-606607	1-606607	1-606607	1-6875	1-6875	1-6875	1-6875		
1-781797		1-755630	1-755630	1-777778	1-777778	1-777778						1-779785	1-779785
1-887748	B	1-872885					1-875	1-875	1-875	1-808438	1-808438	1-808438	1-808438

is a new note having ratio $135/128$ to the nearest note of the previous key. For each move into the next flat key the fourth note of the scale is a new note having the ratio $128/135$ to the nearest note of the former key and the sixth note requires flattening in the ratio $80/81$.

Table IV expresses the same information as Table III in more readable decimal form.

Figure 2 (see p. 476) is a graphical presentation of some of these facts. For this purpose a logarithmic scale of frequency is appropriate since it allows equal frequency ratios to show as equal distances*. On the logarithmic plot the octave is divided into 12 equal parts (Even Tempered semitones), and each of these into 100 parts or 'cents'. Figure 2, Scale 3, shows the 'Just Diatonic' scale defined above; Scales 1 and 2 are earlier versions of it.

Table V expresses the information of Tables III and IV in logarithmic form, the quantity tabulated being the difference of the frequency ratio from the nearest Even Tempered semitone.

Any of the plots of Figure 2 can be used to establish in slide-rule fashion the transposing properties of the scale concerned. The only difficulty is that the necessary reading accuracy requires a rather large size of plot. (*A musical demonstration was then given.*) Figure 2, Scale 4, is the complete plot of Table IV and can be regarded as the result of carrying out this slide-rule operation six times in each direction.

From Scale 4 or Table V we read some striking information: In the 13 keys, five notes (C, D, E, G, A) are doublets, with separation 21.6 cents in each case. The remaining 12 notes are triplets, an additional separation of 1.9 cents occurring. Scale 4 also indicates clearly those keys in which the elements of the doublets or triplets occur; keys are denoted by the number of sharps (above the base line) or flats (below the base line).

The transposition process has been carried to six keys each way in order to close the cycle and allow comparison of the keys $F\sharp$ and $G\flat$, which we are accustomed to consider coincident. It would seem that in fact these two keys are identical in intervals but separated bodily by the interval $21.5 + 1.9$ or 23.4 cents. That this constant interval must occur is easily seen; starting from the key of $G\flat$ we will reach the scale of $F\sharp$ by 12 successive transpositions of a perfect fifth, and we accordingly recognize this interval as the Comma of Pythagoras, namely the ratio $(\frac{3}{2})^{12}/2^7$ or 1.01364 or 23.4 cents.

The two fixed interval adjustments which dominate the transposition process are now identified as the Commas of Pythagoras and Didymus. (The difference between them, 1.9 cents, also carries a name, the Skhisma.)

* Some musicians may be surprised and apprehensive at the introduction of logarithms into their subject. They should not be, since they can claim to have invented logarithms some centuries ahead of the mathematicians. That this is so is shown by the linear nature of the stave scale in Figure 2. The piano keyboard itself has a logarithmic scale of frequency; a consideration which will doubtless be of great value to pianists in developing their technique.

TABLE V

		G♭	D♭	A♭	E♭	B♭	F	C	G	D	A	E	B	F♯
C	0		- 21.5	- 21.5	0	0	0	0	0	0				
	100	- 9.7	- 9.7	- 9.7						- 7.8	- 7.8	- 7.8	+ 13.7	+ 13.7
D	200				- 17.5	- 17.5	- 17.5	+ 4.0	+ 4.0	+ 4.0	+ 4.0			
	300	- 25.4	- 5.8	- 5.8	- 5.8	- 5.8						- 3.9	- 3.9	- 3.9
E	400						- 13.6	- 13.6	- 13.6	+ 7.9	+ 7.9	+ 7.9	+ 7.9	
F	500	- 23.4	- 23.4	- 23.4	- 1.9	- 1.9	- 1.9	- 1.9						0
	600	- 11.7	- 11.7						- 9.8	- 9.8	- 9.8	+ 11.7	+ 11.7	+ 11.7
G	700			- 19.6	- 19.6	- 19.6	+ 1.9	+ 1.9	+ 1.9	+ 1.9				
	800	- 7.7	- 7.7	- 7.7	- 7.7						- 5.8	- 5.8	- 5.8	+ 15.8
A	900					- 15.7	- 15.7	- 15.7	+ 5.8	+ 5.8	+ 5.8	+ 5.8		
	1000	- 25.2	- 25.2	- 3.7	- 3.7	- 3.7	- 3.7						- 1.8	- 1.8
B	1100	- 13.7						- 11.6	- 11.6	- 11.6	+ 9.8	+ 9.8	+ 9.8	+ 9.8

Even Temperament

The Even Tempered scale has by now crept unobtrusively into the discussion, being latent in the ruling on which the plots of Figure 2 are laid out. It consists of 12 equal intervals of $^{12}\sqrt{2}$ ($= 1.059463$). Its relation to the diatonic scales is evident without further discussion. That it should be acceptable as a musical scale is however by no means predictable, and indeed its introduction was not without considerable opposition. Thus in the literature of the transition period we read such expressions as 'the horrible cacophony of harmony of the Even Tempered scale'³.

By resorting to an Even Tempered scale we lose all the difficulties which arise from the existence of commas, these being in general an expression of the inequality $(\frac{r}{n})^r \neq (\frac{p}{q})^s$, where all the symbols are (positive) integers. But we also lose the full consonance arising from the occurrence of integral frequency ratios*. Further we lose a former peculiarity of keyed instruments, namely the association of individual 'colours' to the various keys, arising from the fact that in the absence of Even Temper no two keys show exactly the same system of intervals.

One commonly reads that J. S. Bach was a vigorous supporter of Even Temper and that the 48 Preludes and Fugues were written to demonstrate its capabilities. But there are difficulties in accepting this statement. In the first place, it seems

* It is to be noted that the general tendency of modern music towards exploitation of dissonances is a fact which favours (and may partly derive from) the Even Tempered scale.

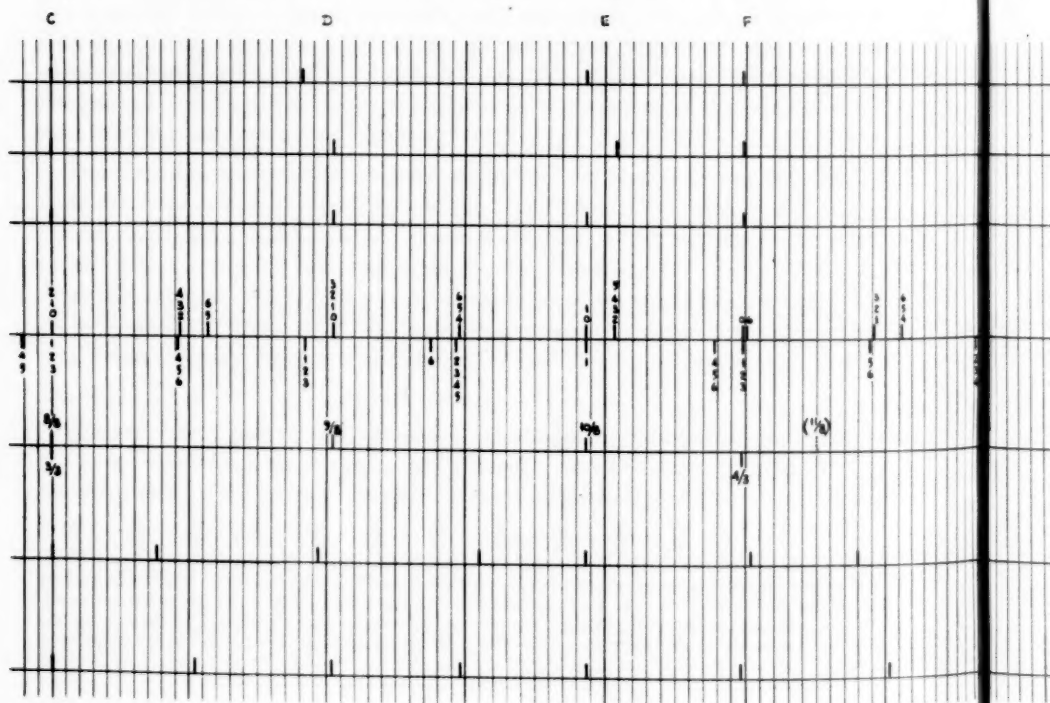
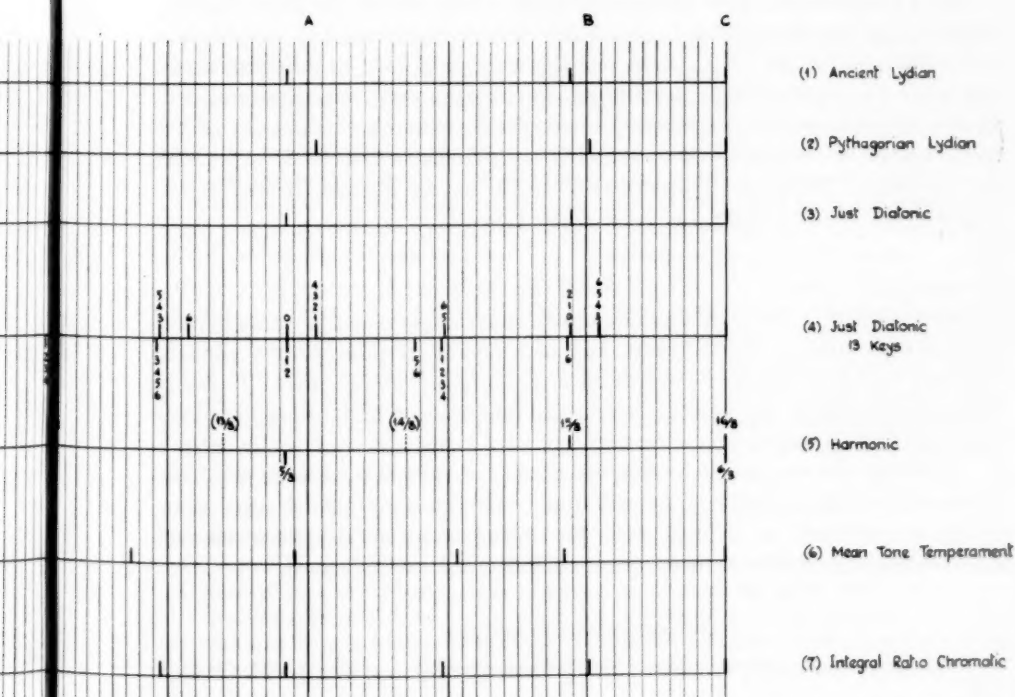


FIGURE 2

fairly certain that Bach never played an Even Tempered organ, at least not habitually, and that the 'well tempering' of the clavichord on an Even Tempered basis is attributable to C. P. E. Bach rather than to his father. Again a set of 48 pieces to demonstrate this thesis contains a redundancy factor of 24. Even for so prolific a composer as J. S. Bach, this seems a little excessive. It is therefore likely that the 'well tempering' here referred to was in the nature of an approximation to the Even Temper, and indeed it is difficult to see how this could have been otherwise bearing in mind the difficulties accruing from the high decrement of the clavichord tone and the limitation of technical facilities.

What advantage could be expected from a departure from Even Temperament? One frequently reads that orchestras and unaccompanied choirs adopt Just intonation. The writer cannot accept this literally for the following reasons:

- (a) Historically the organ was introduced into the Church in order to assist intonation of the choir, and it has been doing this *in Even Temper* for the last 100 years.
- (b) No noticeable change in orchestral quality is observed when accompanying a *piano concerto*; for it is scarcely conceivable (or is it?) that the soloist should play in Even Temperament against an accompaniment in just diatonic.
- (c) So much of one's musical education is based on an Even Tempered instrument that it would be as difficult for an orchestra to achieve just intonation as it would be for the audience to fail to notice it.



(Larger copies of this chart at 24 inches per octave may be obtained on application from the author)

Other Scales.

Figure 2 also records the following scales or temperaments:

Scale 5: This is really an expression of part of Table 1; it shows the harmonics based on fundamentals of $\frac{1}{3}$ and $\frac{1}{8}$ the keynote frequency. If frequencies $\frac{11}{8}$ and $\frac{13}{8}$ are excluded one reaches the Just Diatonic scale.

Scale 6: The Mean Tone temperament. This was in general use for pianoforte and organ tuning for a long period prior to its displacement by Even Temper. A number of versions are recorded of which Scale 6 is representative of later practice.

Scale 7: As recently as 1953 a new scale was proposed by Simonton⁴, entitled 'Integral Ratio Chromatic'. This scale has the following arithmetically beautiful scheme:

1											
$\frac{16}{16}$	$\frac{17}{16}$	$\frac{18}{16}$	$\frac{19}{16}$	$\frac{20}{16}$							
				$\frac{15}{12}$	$\frac{16}{12}$	$\frac{17}{12}$	$\frac{18}{12}$	$\frac{19}{12}$	$\frac{20}{12}$		
										$\frac{15}{9}$	$\frac{16}{9}$
										$\frac{17}{9}$	$\frac{(18)}{9}$

The present writer, who had been seeking a way out of the Even Temper disadvantage mentioned above, namely the loss of individual key colours, was much attracted by the I.R.C. scale, and therefore proceeded to tune a piano on this basis. Expectations were not fulfilled; key colours were indeed restored but, in the writer's opinion, in a highly unacceptable manner, reminiscent of the worst defects of the Just Diatonic scale. This experience serves to show the high noticeability of quite small departures from the accepted scales as well as the impossibility of pre-judging a scale on a paper basis.

CONCLUSION

One frequently reads of endeavours to reproduce major classical works in their original orchestral or choral format, and such efforts are praiseworthy enough. But does one ever hear of a production in the original temperament? Probably not, since the subject has practically subsided into oblivion under the triumphant impact of Even Temper. Therefore the proposal of a new scale such as Simonton's is refreshing and encouraging, irrespective of one's personal assessment of the outcome. But the triumph of Even Temper rests on instrumental restrictions which are coming to an end with the introduction of electronic musical instruments. The future remains open to a wide range of conjecture.

MUSICAL DEMONSTRATIONS

These were based on two pianos, kindly loaned by Messrs. Charles H. Challen

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& Son, Ltd., tuned one in Even Temperament and one in Just Diatonic. The respective tunings were:

I	I	
1'059463		1'054688
1'122462	1'125	
1'189207	1'185185	
1'259921	1'25	
1'334840	1'333333	
1'414214		1'406250
1'498307	1'5	
1'387401	1'580247	
1'681793	1'666667	
1'781797	1'777778	
1'887748	1'875	

The demonstrations included: Comparison of scales, intervals, and chords; excerpts from Bach's 48 Preludes and Fugues; music written specifically for unaccompanied choir; excerpts from a piano concerto (accompaniment in Just intonation).

REFERENCES

1. A. J. Ellis, Tonometric Observation on some existing non-harmonic scales, *Proc. of Royal Society*, Vol. XXXVII 20th November, 1884.
2. A. J. Ellis, On the musical scales of various nations, *Jnl. of Royal Society of Arts*, Vol. XXXIII, 27th March, 1885.
3. H. Fletcher, *Speech and hearing in communication*.
4. Helmholtz, *Sensations of tone*, Chap. 16.
4. T. E. Simonton, *Jnl. of Acoustical Society of America*, November, 1953.

DISCUSSION

MISS DORIS HIBBERT: Could Mr. Bedford tell us how he tuned the piano in Just Temperament?

THE LECTURER: I used electronic aids which I find not only useful but essential! I think the tuning is very accurate. I use a very stable electronic oscillator, calibrated against a crystal. The piano-string frequencies are compared with this and the beats are displayed visually. I reckon to work to an accuracy of about one cent.

In the case of the Just Diatonic tuning, where only integral ratios are concerned, I was able to use only the key-note frequency from the oscillator; hence the calibration of the oscillator is not involved, but only its short-term (two hour) stability.

MR. HENRY WILLIS: I would suggest that no matter how accurately by electronic or other aids one of the pianos used in the demonstrations was tuned to Just Intonation, it must have slipped somewhat since the tuning.

THE LECTURER: I would very much like to cross swords with you on that point. I think that the piano tuning is very accurate indeed, but, subject to measurement, I must bow to your ear in the matter. I am going to make a rude suggestion to you. I do not believe that you have ever heard Just Temperament. I think it has not been heard for 100 years, and you cannot be as old as that!

MR. WILLIS: When I was a very young apprentice, I was taught Mean tone or Just intonation to show me what to avoid!

MR. M. T. BIZONY: Does Mr. Bedford agree that with Even Temperament it is a waste of time for a composer to make any sort of fuss about the key he is writing in except whether it is a minor or major key? Anything else that he may determine by writing in A major rather than in say, B major is merely the pitch; but if we have Just Diatonic scale, then we retain an individual quality with each key.

THE LECTURER: I agree with that statement, and I am very glad you have raised the point; I omitted it for the sake of brevity, but it is a very important one. There is this residual question: does there exist individual key colour in spite of Even Temperament? When I play the piano myself I suspect that there is, but I am unable to detect it from someone else's playing.

One of my reasons for exploring this apparently dead piece of ground (for after all this subject was wound up at the end of the last century and buried) is that, as I have hinted, I am very interested in electronic organ design, and the question of temperament is most important. I was very reluctant to see a complete loss of key colours by the adoption of Even Temper, and I was looking for some way of restoring individual key colour. Of course, you can get it, but I regret to say that every scheme I have tried I have found extremely disagreeable. I have grown absolutely Even-tempered ears as a result of my investigations.

DR. G. L. HAMBURGER: I find it extremely difficult, first of all, to find any significant difference between the two pianos used for the demonstrations. I must admit that the lecturer played essentially things in one key, the main one being D major.

Although I have been interested in music all my life, I may have been spoiled in my hearing, as in the first place I was interested in the piano, which is usually an Even-tempered instrument. Had I been an oboe player I might have thought differently. But it seems that, maybe due to the fact that the majority of people are educated on the piano and have a lot to do with it, the taste of the finer feeling for these differences has been blunted in a way. This limitation must have cost me much, insofar as I still cannot hear the difference between the two pianos—in the way of hearing alternative examples. Of course, if two notes are struck at the same time I perceive the beat, but otherwise I find there is very little in it.

MR. CLIFFORD LAWSON-REECE: Profoundly impressed though I was by the admirable demonstrations on these two pianos, I cannot help feeling that one may be beguiled by the characteristics of one particular piano into thinking that what one hears is a function of the scale when it may be a function of that particular instrument. Has Mr. Bedford succeeded in making any device work on piano or organ for shifting the temperament in the same instrument?

THE LECTURER: I have conceived such a device, but I have not produced it. That, of course, will only apply to electronic instruments and is quite out of the question, in my opinion, on a mechanical one.

BRIGADIER J. L. P. MACNAIR: The lecturer wondered how it was that the orchestra managed to keep in tune with the piano when playing a piano concerto. He also said he would not use voices in this meeting because a voice never kept in tune. Fair enough. Exactly the same thing of course applies to those parts of an orchestra who can adjust their pitch. The wind instruments are not quite so easy, but if the strings of an orchestra are playing with the piano, they always quite naturally tune themselves to the piano. In connection with that it is interesting to remember that the old harmonists refused composers the use of consecutive fifths. My impression is that though the reasons advanced for that had something to do with the mixup of keys, the real reason is probably much more closely connected with the Even-tempered scale, which gets you in the wrong if you do try to use consecutive fifths. It is true that modern composers are tending to bring back consecutive fifths, but they are doing that as a matter of brute force rather than theory. If you play consecutive fifths on a violin they sound perfectly alright because the violinist can adjust the intervals correctly.

Although the impressive hymn of Benjamin Britten's was very good, I wonder if you are acquainted with Holst's treatment of the hymn known as *Turn Back O Man*,

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which I think is even more impressive in the remarkable way, harmonically, that he deals with these changes of key.

THE CHAIRMAN: I think that the lecturer had a bitter lesson when he heard us sing in various temperaments in the hymn!

MR. ARTHUR PRIESTLEY: Would the lecturer agree that the particular colours which some people claim to feel as belonging to different musical keys may in fact be related to the position of the hands on the keyboard, to the comparative difficulty of a scale, and so on? Would one have a favourite key as dictated by that? Does a person with a sense of absolute pitch, not knowing what key is being played, detect any difference between the keys? And with regard to the performance of a piano concerto, is it not true that most of the string players use a pronounced *vibrato* which irons out the discrepancies between tempered and untempered scales?

THE LECTURER: I think I agree with both your points. The hand position has a lot to do with it, and I certainly agree with you about *vibrato*.

A vote of thanks to the Lecturer was carried with acclamation, and the meeting then ended.

The following communication has since been received from Mr. Bedford:

Since my suggestion that the future of the organ lies in the electronic version met, as expected, a strong opposition, may I be allowed to develop this theme?

It is fairly generally experienced that, when one changes over from a mechanical to an electronic solution to a given problem, one finds that the latter is over-solved in the sense that one has introduced tremendous reserve factors and an unprecedented flexibility. The 'dividend' can be taken up in various ways. In the case of the electronic organ, it has hitherto been almost exclusively taken up in cost economy. Thus when we compare pipe organs and electronic organs, we are usually comparing instruments in totally different price categories; indeed, the price ratio may exceed ten to one. In these circumstances, it is hardly surprising if the electronic organ falls short of the pipe organ as a serious musical instrument. Its very cheapness has tended to accentuate its application (with good effect) to light music; and incidentally, for no apparent reason, to the especial use of organists who have suffered the loss of the right leg.

If, however, one is prepared to sacrifice some part of the great economy offered by the electronic solution then the situation may be transformed. In the first place, the output amplifier and transducer may be stepped up from, say, twenty watts to two hundred watts or more. Next, all the important organ tones can be produced with adequate accuracy, and in addition new tones unknown to the pipe organ can be produced. The dynamic range of the 'swell' is enormously increased and can be applied to stops individually. Similar remarks apply to *tremolo* and *vibrato* tones.

Then there are the possibilities relevant to the present paper, hitherto quite unexploited, that the temperament can be altered in play. This would imply the provision of a range of buttons to cause the temperament to be shifted with modulation. In the converse direction when playing in Even Temper one might wish to resort to 'tempered harmonics'. (This is already done in the Hammond organ, probably for reasons of economy only; it is an interesting effect and should be of value if not applied exclusively.)

Finally, we may note that the electronic organ can be tuned in five minutes and will stay accurately in tune for an indefinite period. It is suggested that the pipe organ presents the exact antithesis.

In view of the above, and having regard to the general trend of events in technology and instrumentation, it seems reasonable to conclude that within the next hundred years it will be as unnatural to design an organ on a pipe basis as it would be to-day to design a television receiver with a mechanical scanning disc.

THE SECOND EVENING DISCUSSION MEETING

SPORT WITH SOME REFERENCE TO THE GROWTH OF PROFESSIONALISM

The second of the three evening discussion meetings arranged for the present Session was held on Wednesday, 29th February, the subject for discussion being introduced by Mr. Denzil Batchelor. The meeting was presided over by Sir Harold Saunders, a Member of Council of the Society.

Mr. Batchelor said that he wished to confine his remarks to the place of sport in present-day society. The appeal of sport in the modern world could be held to be desirable, and should not be derided. Sport, to be worth-while, had two immense charms, and if it lacked either of them it would not be worth watching: it was an art, and it appealed to the human interest in the competitive or gladiatorial. No sport which was not beautiful in movement was fit to be watched. Sport to-day had, however, developed into an industry. Was that to its advantage and benefit, and what was the result of the professionalization of sport? The instance of the 1952 Olympic Games was quoted when, of the 69 nations taking the oath of amateurism, there were in fact very few amateur teams. That was not far from the truth at Cortina this winter. There the two great countries which led the way were America and Russia. The Russians said that every member of their team was a full-time worker. Their best skier worked in a metallurgical factory—but he had not clocked in for four years. He lost the combined events, and sadly commented, 'Back to the metallurgical factory!' There was no doubt that any Russian teams sent to this country were on propaganda missions, and in fact endeared their country to the British public by playing extremely good sport. They were undoubtedly playing for world popularity through their sportsmen.

On the other side of the fence there was America, who had recently disqualified Santee. There were cases of American athletes who received expenses and other monies, and there was no doubt that any first-class American athlete was able to earn his living out of sport as an amateur.

In lawn tennis, which prided itself on amateurism, amateurs and professionals were not allowed to meet. A critic had been once heard to say, when a British champion was knocked out at Wimbledon, that if things got any worse some of our professionals would have to turn amateur to make a good living!

We spent as a nation more on gambling than we did on police stations or education, with the possible exception of university education. In 1954 £350 million was spent on horse racing, £120 million on dog racing, £74 million on football pools, and £6 million on other forms of gambling—a total of £550 million. £9 million also went to the Irish sweepstake, of which 3s. 9d. in every pound spent benefited the hospitals.

Cricket was one of the least rewarding of sports financially. A good cricketer received £15 a week during the summer, and £6 during the winter, whereas in lawn tennis a player would make £15,000 in his first year as a professional. A golfer could make £3,000 a year, and he could keep it up till he was 45 through

teaching and coaching. Probably one of the highest paid of all sportsmen was the winner of the Tour de France, mainly because of the sums gained by the winner through advertising. Footballers were paid £15 a week during the winter, whereas some baseball players earned £33,000 a year. The most successful boxers also received huge sums of money: Joe Louis made £1 million.

In the general discussion which followed, the point of view of the seasoned lawn tennis player was put. For example, when playing at Queen's Club thirty years ago, one speaker had had to wait all day for a well-known British player. When he complained that he had a business to attend to, the referee told him that he had no right to have a business and play tennis! On the question of expenses, a certain famous Australian player demanded £20 a day for himself, while even moderate players wanted large sums.

The view was expressed that professional and pseudo-professional sport should be regarded as a form of exhibition. This was quite different from the position of the man who played the game himself and who went to see the expert for the pleasure of learning how the game should be played. It did not matter very much whether the exponents of those sports which were most beautiful to watch were professionals or not. Football and cricket owed a great deal to the professionals. They played the game because they loved it, and they could not afford to play for pleasure only. They were as good sportsmen as the average amateur. Again, it was not felt to matter that so much money was spent on one particular form of entertainment. Not professionalism as such, but sham amateurism, was felt to be undesirable. The Olympic oath of amateurism, reasonable in 1896 was now, it was held, an anachronism. It was suggested that the need to-day was for a distinction between the professional and the pseudo-amateur to be broken down.

In team games also just as much interest and excitement could be derived from seeing a very moderate team playing a good and enthusiastic game, because here was a combination of people who had been accustomed to playing together. It was very important that in decrying the professional form of sport it should not be implied that amateur sport was not immensely valuable. The experience derived from playing difficult games at school under uncomfortable conditions was, it was suggested, extremely valuable later in life.

It was suggested that promoters of football pools might be encouraged to give a small percentage of their profits to pay for the training in sport of young people who showed talent. The view was put forward that it was generally the sporting bodies themselves who declined to accept such money because, if the pools promoters helped to pay for the education and development of promising young athletes, they would want a say in the handling of the sport, which was not felt to be desirable. As against that, Swiss state-controlled pools on British football had subsidized the Swiss contingents at the Olympic Games. Such a scheme, it was held, might be feasible here if legislation were strong enough to prevent the promoters from having any say whatsoever in the game, but it would require strict controls and an impartial administering body.

Other points touched on were the shortage of playing fields in London; the

disproportionately large amount of space devoted in newspapers to sport; the need for greater accommodation at sporting events, and the lionizing overseas of ace cyclists.

Those who took part in the discussion included Mr. A. C. Chappelow, Wing-Commander T. R. Cave-Browne-Cave and Mrs. Hamilton Ellis.

GENERAL NOTES

THE ROYAL ACADEMY SUMMER EXHIBITION

Since the last war, and especially in the last few years, the Summer Exhibitions of the Royal Academy have undoubtedly given a truer notion of the prevailing artistic climate than at any time since the later Victorian age. The present 188th Exhibition, which mixes expressionist or inventive realist painting with the Academy's more conventional products, certainly seems as adventurous as the institution can well contrive. No Hanging Committee, of course—not even one that includes, as this does, artists as liberal-minded as Mr. Ruskin Spear, Mr. James Fitton, or Mr. Rodney Burn—can hang abstractions if the better abstract painters hold back, or persuade such distinguished outsiders as Sir Jacob Epstein and Mr. Moore, Mr. Sutherland or Sir Matthew Smith to come in against their will. What, however, can truly be said is that the progressive element within the Academy is now sufficiently strong to ensure that such lamentable mistakes of the past as the rejection of an important Wyndham Lewis portrait are now unthinkable.

Anyone can imagine how various are the personalities, and conflicting the opinions, within an assembly like the Academic body; and it says much for the diplomacy of the President, Professor Sir Albert Richardson, that a catholic policy has neither restrained a freedom of artistic expression, nor endangered an annual attendance which hitherto has consisted largely of very conservative supporters. Evidently that public is not so insular as it was before the war, and in meeting a more informed taste—indeed, in helping to raise it—the Royal Academy is certainly not being untrue to its heritage, and can suffer an occasional outraged protest with some composure. The Academy of such independent and questing masters as Constable and Turner, with their great influence on French thought, was very far from being a backward institution, the reproach which for so long afterwards it was to carry.

All this is not to suggest that the present exhibition approximates to a kind of enlarged London Group show, though there is, in fact, some semblance of it in Galleries VII and VIII. The most conservative visitor may be reassured, as he mounts the staircase, by the extraordinary fidelity of Mr. Maurice Lambert's bronze figure of Dame Margot Fonteyn in the Central Hall, an effigy faithful even to the artificial eyelashes observable on closer inspection; and fortified by what is, after all, something of a *tour de force* of its kind, the same visitor may only begin to feel misgivings about such theatrical naturalism when he encounters a sample as meretricious as Signor Annigoni's painting of the same *ballerina*.

If it be true that most ordinary visitors have become better acquainted with serious (as opposed to popular) painting, one may hope they will appreciate, by contrast, the grave distinction of Professor Rodrigo Moynihan's half-length portrait of the Earl of Radnor, rightly hung in the main gallery. It might be called a 'thinking likeness'; and if the features appear unduly pensive to those who know our Bicentenary Chairman, it might be remembered that a cast of expression natural for anyone enduring long sittings is also typical of the meditative portraiture of that Euston Road Group in which the artist's style was formed. This is, in fact, one of several paintings that command attention in a gallery inevitably dominated by Mr. Ruskin Spear's powerful figure of Sir Laurence Olivier in the character of Macbeth, a giant trapped and awaiting the final catastrophe. It is flanked by Mr. R. O. Dunlop's large

and substantial Spring landscape, which holds its own well against Mr. Alan Reynolds' imaginative Summer landscape, recently seen at the Redfern Gallery, and now exhibited as a Chantrey purchase.

In an exhibition containing over 1,400 items, it is only possible to indicate general trends and illustrate them with a few examples. One effect of spreading so many interesting and unorthodox paintings throughout the galleries has been to divert attention from the more formal and conventional portraiture, such as normally gratifies private viewers. However, a former Master of the Leathersellers' Company has been meticulously recorded by Sir Gerald Kelly, as indeed have Lady Lowson and her family by Mr. James Gunn, both artists having fared better than other official portraitists whose canvases have been rather tucked away. There may be noticed, however, in Gallery IV, Miss Anna Zinkeisen's ceremonial portrait of our President, His Royal Highness The Duke of Edinburgh, as Marshal of the Royal Air Force. Also in this room is an extravaganza by Sir Alfred Munnings which depicts a group of visitors, including the Director of the Tate, contemplating an amorphous object which is presumably intended to represent a piece of contemporary sculpture. It is a curious painting, not least because the exaggerated antics correspond so closely to comical Toby-jug ware, the final touch of improbability being added by a country dog to balance the composition.

In addition to satirical paintings, and an unusual number of street scenes, there is a stronger representation than usual of what might be called inventive realist painting, particularly in Galleries VII and VIII. Mr. John Bratby and Mr. Edward Middleditch are two of the younger realists seen here for the first time, not, indeed, as well as they might have been if so many of their canvases had not been reserved for this year's Venice Biennale. Mr. Peter Coker also comes in with his paintings of butchers' carcasses in that dour, relentless mode introduced soon after the last war by the French realists. On the whole, however, it is the more experienced painters who score here, especially Mr. Carel Weight, whose big painting of workers swarming out of a greyhound racing stadium seems, on the face of it, a mass of improbabilities—so imaginatively resolved that the spectator can come to share a visionary experience of a commonplace Saturday event.

The water-colours, drawings and prints maintain their usual standard. A high level of craftsmanship is ensured by the number of members of the Royal Water-Colour and Painter-Etcher Societies who annually exhibit; and it is refreshing when craftsmanship is combined with such imagination as is displayed by Mr. Farleigh in the black-and-white room, or Mr. Vivian Pitchforth in his fluid and spacious water-colours. To the South room the President contributes five works, including an architectural *capriccio*, and, elsewhere, his proposed reconstruction of the Merchant Taylor's Hall. Besides Mr. Maurice Lambert's bronze dancer, already mentioned, there may be noticed good characteristic sculptures by Mr. Willi Soukop and Mr. Siegfried Charoux, a conspicuous bronze of a *Little Girl* by Mr. Sydney Harpley, rather after the manner of Manzù, and Mr. Frank Dobson's *terra-cotta* statue which is no less monumental for its small scale. There is no reason to suppose that this diversified, and often adventurous, exhibition will fail to draw crowds almost as great as the record attendance last year.

As much space is certainly due to the important exhibition of German painting, 1850–1950, at the Tate Gallery, though it must suffice to comment on it briefly now, and point out that it is the most representative of its kind yet seen in this country. Not, indeed, since the 1938 exhibition of modern German art banned by Hitler has anything approaching the present collection of over 250 paintings and drawings been brought to London. In addition to the more prominent German painters of the last century, the exhibition includes valuable groups of paintings by Klee, Kandinsky, and Herr Kokoschka, whose influence on modern art has been pervasive.

NEVILLE WALLIS

THE LIBRARY

The definition of a policy for the Library of a body such as the Royal Society of Arts, which is so wide in its scope but restricted in its library space is not a simple problem. Practical considerations necessitate a considerable degree of specialization within the extremely broad field covered by the Society but the selection of the most suitable specialized subjects must depend on varying circumstances, some of them, such as the existence of other collections, external, and the matter therefore calls for periodical review. It may be helpful to Fellows to publish the following list of subjects upon which the present policy is to concentrate and to draw their attention to the fact that a number of volumes outside these categories have recently been disposed of in order to make space for growing collections within the chosen categories. The subjects in which the Library is now specializing are as follows:

THE ROYAL SOCIETY OF ARTS: The history of the Society is illustrated by its published proceedings and manuscript records, and by secondary works on technological, economic, social and art history.

OTHER LEARNED SOCIETIES: The domestic histories of other societies are of continuing value to the Library.

EXHIBITIONS: Because of the Society's pioneer work in this sphere, the Library will continue to add to its collection catalogues and descriptive works relating to the major international exhibitions, and any small ones particularly concerned with industrial design or showing advanced exhibition architecture or display.

SCIENCE, AGRICULTURE AND TECHNOLOGY: The Library attempts to cover the general history of science, technology and agriculture, with particular emphasis on the period 1750-1850. But it cannot concern itself with the history of science and technology since 1875. The Society's journal is a reasonably good source for much of this history, and it is clearly impossible to cover the vast subject adequately.

ENGLISH HISTORY: The Library has a limited collection of background material and emphasis is placed on economic and social history since 1700.

THE HISTORY AND TOPOGRAPHY OF LONDON: There is a small but useful collection of books on this subject.

BOOKS PUBLISHED BEFORE 1830: The Library has an interesting collection of books on technology, commerce and agriculture published before 1830, many of which are known to have belonged to the Society since the eighteenth century. They are equally useful for the documentation of the Society's own history and to the section on the history of technology.

THE INDUSTRIAL ARTS: The Library will continue to make the industrial arts its main subject. There is already a good and useful collection; the periodicals particularly are valuable, and their value will naturally increase with every year's addition.

The Library endeavours to cover all branches of design, English, Commonwealth and foreign, with adequate illustration. Much of the illustration, and some of the information, required can be found in periodicals: for example, current machine design is only well represented in the United States periodical *Industrial Design* and the Italian *Stile Industria*. There are also books on what may be called industrial aesthetics (as opposed to practical design). The history of design and the history of taste since 1750 are covered; an attempt is being made to see that all periods are adequately represented in such branches as furniture and textiles, and that the Library shall contain illustrated examples of pattern and ornament of all periods and countries.

The development of taste is illustrated by the history of architecture and the fine arts as well as the industrial arts; and the history of English painting in the period 1750-1850 also has particular relevance to the Society's history. But from 1850 development in design in the industrial arts and architecture, and to a lesser extent painting and sculpture, cannot really be separated; from William Morris onwards the same aesthetics have found expression alike in architectural and industrial design, and since these aesthetics, which in the result become styles, are the basis on which

design for whatever purpose is critically considered and historically placed, material has to be provided for their illustration in all their manifestations.

BOUND PERIODICALS: Back numbers of the following periodicals have been kept and bound since the date shown. Fellows are reminded that they can be borrowed on the same conditions as other works in the loan library.

<i>Agricultural history</i> (American)	1950
<i>Agriculture</i> (<i>Journal of the Ministry of Agriculture</i>)	1949
<i>Ambassador</i>	1949
<i>American philosophical society</i> (<i>Proceedings</i>)	1744 (less 1928-48)
<i>Antiquaries journal</i>	1921 (less 1939-48)
<i>Architectural design</i>	1951
<i>Architectural review</i>	1949
<i>Architecture and building</i>	1949
<i>Archives</i>	1949
<i>Ark</i> (<i>Journal of the Royal College of Art</i>)	1951
<i>Arts and architecture</i> (American)	1950
<i>Art and industry</i>	1949
<i>Art et industrie</i> (French)	1948
<i>Art and letters</i> (India and Pakistan)	1948
<i>Asian review</i>	1952
<i>Aslib proceedings</i>	1950
<i>Bhandarkar oriental research institute</i>	1947
<i>Bonytt</i> (Norwegian)	1949
<i>B.B.C. quarterly</i>	1949
<i>British plastics</i>	1949
<i>British society of master glass-painters</i> (<i>Journal</i>)	1949
<i>Burlington magazine</i>	1953
<i>Canadian art</i>	1949
<i>Ciba review</i> (Swiss)	1937
<i>Colonial geology and mineral resources</i>	1950
<i>Colonial plant and animal products</i>	1950
<i>Country life</i>	1949
<i>Dansk kunsthåndværk</i> (Danish)	1948
<i>Design</i>	1949
<i>Discovery</i>	1948
<i>Display</i>	1949
<i>Domus</i> (Italian)	1949
<i>Edilizia moderna</i> (Italian)	1949
<i>Endeavour</i>	1949
<i>Far and wide</i>	1948
<i>Form</i> (Swedish)	1948
<i>Gebrauchsgraphic</i> (German)	1953
<i>Geographical journal</i>	1857 (less 1939-48)
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<i>Manchester literary and philosophical society (Memoirs and Proceedings)</i>		1789 (less 1922-39)
<i>Marg (Indian)</i>		1950
<i>Moebel decoration (German)</i>		1956
<i>Museums journal</i>		1949
<i>Nature</i>		1893 (less 1937-48)
<i>New Commonwealth</i>		1951
<i>Notes and queries</i>		1852 (less 1922-48)
<i>Official architecture and planning</i>		1949
<i>Packaging review</i>		1949
<i>Photographic journal</i>		1876 (less 1939-48)
<i>Pottery and glass</i>		1949
<i>Print (American)</i>		1955
<i>Publimondial (French)</i>		1953
<i>Research</i>		1949
<i>Royal agricultural society of England (Journal)</i>		1840 (less 1938-43)
<i>Royal Asiatic society (Journal)</i>		1948
<i>Royal institute of British architects (Journal and Library Bulletin)</i>		1948
<i>Royal institution of Great Britain (Proceedings)</i>		1802
<i>Royal philosophical society of Glasgow (Proceedings)</i>		1946
<i>Royal society of Edinburgh (Transactions)</i>		1948
<i>Royal society of Edinburgh (Proceedings)</i>		1946
<i>Royal statistical society (Journal)</i>		1948
<i>Scientific American</i>		1949
<i>Scope</i>		1948
<i>Scottish art review</i>		1949
<i>Society of archivists (Journal)</i>		1955
<i>Society of industrial artists (Journal)</i>		1948
<i>Stile industria (Italian)</i>		1954
<i>Studio</i>		1948
<i>Tata quarterly</i>		1952
<i>Textile institute journal</i>		1953
<i>Textile manufacturer</i>		1949
<i>Times literary supplement</i>		1949
<i>Town planning institute journal</i>		1949
<i>United empire</i>		1869 (less 1942-48)
<i>Wood</i>		1949

IMPERIAL INSTITUTE

The Annual Report of the Imperial Institute for 1955 is once again a record of expansion in all the activities of the Institute. The Director points out that the life of the Institute itself is not threatened by the controversy over its building, as new premises are promised by the Government, and draws attention to the fact that the Institute is beginning to fulfil its proper function as the natural 'home' of Commonwealth art from overseas in London.

Notable among the developments in 1955 was the increase in the conferences held all over the country, for sixth-form pupils and for teachers' training colleges. The recently founded Commonwealth students' club has also grown rapidly.

PAKISTAN PANORAMA EXHIBITION

The first Exhibition to be held in Europe showing the products of Pakistan cottage industries was opened by His Excellency the High Commissioner for Pakistan on Thursday, 3rd May, in the Exhibition Hall of Selfridges, Ltd. The High Commissioner referred in his speech to the Small Industries Corporation which is at

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GENERAL NOTES

present being set up to market the products of cottage industries in Pakistan, and said that it is intended to open a display centre in this country where examples of these products can be inspected by potential importers.

The Exhibition closes on Saturday, 12th May, at 1 p.m.

NEW TECHNICAL JOURNAL

The first number of *British Chemical Engineering*, a journal devoted to the techniques of chemical engineering applied to industry, appears this month. It contains articles on a wide range of subjects falling within this technology, together with a book review section, and future monthly issues will provide a review of the rapid developments in this field. *British Chemical Engineering* is published by Heywood and Co., Ltd., Drury House, Russell Street, London, W.C.2, at the price of 2s. 6d. A subscription rate of £1 10s. for 12 issues is also available.

TECHNICAL EDUCATION

Three of the addresses given at the annual meeting of the National Institute of Adult Education, at which the subject of technical education was discussed, have been published by the Institute in a booklet entitled *Adult Education and Working Life*. The titles are 'Liberal Education in a Technical Age', by Sir Robert Wood; 'Liberal Education and Industrial Efficiency', by Norman Fisher, and 'Liberal Education in the Technical College', by D. E. Mumford. The booklet is obtainable from: The National Institute of Adult Education, 35 Queen Anne Street, London, W.1, price 2s. 6d.

THE DESIGN CENTRE

The Design Centre for British industries was opened by His Royal Highness The Duke of Edinburgh, on 27th April. The new Centre, at the headquarters of the Council of Industrial Design at 28 Haymarket, London, S.W.1, is designed to provide a permanent but changing exhibition of examples of the goods included in Design Review. The latter is the photographic record of those products of British manufacturers which have been approved as reaching the high standard set by the Council of Industrial Design.

The concept of selective exhibitions of manufactured goods is not in itself new, having been first applied by the Society of Arts over a hundred years ago. In March, 1847, the Society held at its House the first of an annual series of exhibitions of 'select specimens of British manufactures', which culminated, in the fifth year, as was planned at the start, with the Great Exhibition of 1851. The same principle underlay the Exhibition of British Art in industry which was held by the Society jointly with the Royal Academy, at Burlington House in 1935.

The important advance now made by the Council of Industrial Design is to establish a similar selective exhibition which will be on view at all times, so that the public will have always available a guide to the best products of British industry. That the public will take advantage of this is already clear from the large crowd which is daily thronging the three large halls of the exhibition, and apparently making full use of the information services provided there. The arrangement of the display area in a series of small sections helps to induce an atmosphere of intimacy in which household furnishings can be well appreciated.

In addition to the Exhibition, which is concentrated mainly on domestic furniture and furnishings, the Centre houses Design Review itself, as well as a reference library and photographic and slide libraries. All the articles exhibited are marked clearly with the name of the manufacturer, and their price is either marked, or obtainable upon request, together with the names of retailers from whom they may be obtained.

The Design Centre is open to the public on weekdays, including Saturdays, from 9.30 a.m. to 5.30 p.m. Admission is free.

OBITUARY

LT.-COL. S. E. GLENDENNING

We record with regret the death, in Norwich recently, of Lieut.-Colonel S. E. Glendenning.

Sydney Elliot Glendenning, D.S.O., T.D., F.S.A., M.I.E.E., a Freeman of the City of Norwich, although by profession an engineer, was closely concerned with the fundamentals of traditional building in East Anglia, on which subject he was an authority. He became a member of the Society for the Protection of Ancient Buildings in 1911, and was for 22 years a member of its committee, on which his great knowledge of the buildings of Norfolk was of great value in furthering the work of the S.P.A.B.

He was elected a Fellow of the Society in 1938.

CORRESPONDENCE

THE IMPERIAL INSTITUTE

The letter which was published in the last issue of the Journal from Mr. Martin A. Buckmaster, who remembers the opening of the Imperial Institute, prompted a request to another Fellow, Mr. Stanley Hamp, formerly a partner of Thomas Colcutt, to contribute to the Journal some remarks on the original plan for the Imperial Institute's site. In reply, the following letter was received

From MR. STANLEY HAMP, F.R.I.B.A., LILLYHORN, OAKRIDGE LYNCH, STROUD, GLOUCESTERSHIRE.

I was too young to remember the erection of the Colcutt building, and the great occasion of its opening, but some years after its completion I was taken in as a pupil by Mr. Colcutt. After qualifying for R.I.B.A., I started in practice on my own, but within a few years Mr. Colcutt asked me to rejoin him as a junior partner and I remained with him until he died.

He was very proud of this work of his—the Imperial Institute—and told me interesting facts as to the lines he worked upon on its erection. The principle underlying the scheme appealed to him, as he at once saw its possibilities. It was a chance for a fine and noble conception. The site available extended then north and south from the Albert Hall to the Natural History Museum, and east and west from Exhibition Road to Queen's Gate. It was quite free of any important existing buildings, forming a rectangular site in which he could design the new building.

He decided to place his building centrally, with the great tower rising to form a fine composition and having space available for the creation of a well-laid-out pleasure garden such as was suggested by the conditions of the competition. The high floors now condemned were required for conference rooms. Visualizing that there might be a change in the future, Mr. Colcutt decided on a height that would make it possible to insert an intermediate floor if required. The Great Hall which he designed was provided as a temporary structure, and long galleries were designed to the north elevation at ground-floor level.

The streets on the east and west sides he designed to be widened and made into tree-lined avenues with government buildings on each frontage. He saw such a scheme as a fine town-planning effect worthy of this Kensington area. Alas, new buildings were allowed to be erected without any regard to each other and in an entirely wrong position. His great vision vanished and this opportunity was lost, with the present result: an illustration of *very bad town planning*. The sites on the opposite side of Queen's Gate and Exhibition Road could now, however, be secured with government powers. These would provide very valuable sites for the enlargement of the Imperial College buildings and for other government buildings and

would form, over a period of years, a fine architectural expansion. Such an opportunity should not now be missed.

The present scheme will be another illustration of that which is done in haste without due consideration ending by being regretted by future generations. The Imperial Institute should have inspired the planners to include it as a unit enhancing the whole scheme, however modern the new architecture might be.

NOTES ON BOOKS

PACKAGE DESIGN. *By Milner Gray. Studio, 1955. 25s*

Packaging is one of the most interesting and stimulating of the fields of design in industry. There are few more direct links, in our commercial world, between the designer and the people around him, and not only is the range of products packed under brand names increasing every day, but new packaging materials and techniques are continually being developed. As Mr. Gray says:

Packaging, in the broad modern sense, involves the service of a vast combination of industries, employing hundreds of thousands of men and women, consuming ton upon ton of paper, board, foil, metal, fibre, film, pulp, glass, clay and plastic powder, and utilizing many types of precision machines to print, press, mould, fold, stopper, seal, twist, count, stamp and shape the millions of containers in which these goods are packed.

The designer, although he must understand them, would be unwise to try to master all the different techniques, and for the student a very valuable part of this book, No. 59 in the 'How To Do It' series, is that in which five experts discuss 'Production Line Technique', 'Printing Processes and Packaging', 'Metal in Packaging', 'Glass in Packaging', and 'Plastics in Packaging'.

All the effort of design is of course dedicated, as Mr. Gray emphasizes, to the hard fact of selling the goods. One manufacturer's salt may look very much like another's in the salt-cellar, but the housewife has got to be persuaded when she is at the shop that so and so's salt is the best. It is at this point, of course, that the strictly visual part of design comes into play. In packaging for the sale of goods 'a serviceable container is not enough', and a mastery of techniques without a feeling for good design will not give the required results. An international choice of illustrations in this book shows many examples of achievement in packaging in this visual rôle, and also in relation to particular problems of protection and distribution.

'In the sphere of design, there is no finality', is a thesis illustrated here by the gradual changes since 1907 in a Cadbury's wrapper. This book very successfully accomplishes what it sets out to do, to give the 'simple technical background facts about packaging', and since there can be no finality there follows the challenge: 'Beyond this it is to himself alone that the student must look'.

MICHAEL OLIVER

TECHNICAL EDUCATION: ITS AIMS, ORGANIZATION AND FUTURE DEVELOPMENT. *By P. F. R. Venables. London, Bell, 1955. 42s*

How to review, in some 600 words, a book of as many well-filled pages? The only thing to do is to start with an assertion couched in superlatives: Dr. Venables has provided us with a major work of most meticulous scholarship, he has composed the heterogeneous activities called technical education into a coherent picture; by skilful writing and pleasant wit he has preserved a monumental mass of data from what would have seemed to be inevitable dullness. In his introductory chapter Dr. Venables regrets that there exists no comprehensive history of English technical education: on the evidence of this volume he is the man to write it.

As T. H. Huxley pointed out in his 1887 Manchester address, 'It passes the wit of man . . . to give a legal definition of technical education', but Dr. Venables has

performed the more useful task of giving an adequate description of it. He shares Huxley's conviction that technical education must be wider than mere instruction and that in the long run the decisive problems of industry are human problems, and he makes it clear that we shall not make up the leeway in the technological race of the nations until technical education is lifted from its present lowly social status.

Recognizing the varied nature of the terrain he is mapping, Dr. Venables has called in specialists to write on engineering, building, art, commerce and the further education of women; but it is the senior author's chapters, fully documented by bibliographic references and clearly illuminated by many excellent tables and charts, which give this volume its classic quality. His account of the character and range of technical education institutions, and of their general working arrangements and courses, is a model of the manipulation of heavy matter into light reading. His description of the complex partnership, involving so many departments, committees, associations and unions, which regulates technical education is clear and precise—but one yearns to manipulate Dr. Venables's own delightful invention, 'a new Occam's razor for Administrators, "Administrative procedures are not to be multiplied without dire necessity"'. It is, however, in the last six chapters of the book that we become really aware of the author's power of mind.

The chapter on 'Higher technological education' begins with a vigorous thrust at the procrastinators and double-talkers of every ilk, proceeds to harass the hair-splitters and cheese-parers, confounds those who lack faith in the intellectual estate of the British people, and playfully pricks those still inhibited by 'our gentlemanly ideals' of education. Next comes a chapter on 'Freedom and governance', boldly claiming for technical colleges some of the autonomy anciently enjoyed by the universities and now extended to every school in Hertfordshire, and making overdue assertion of the proper prerogatives of principals (but, regrettably, saying little about the democratic rights of lecturers *vis-à-vis* principals). All this, and the frequently reiterated complaint of the low status of technical education, and the evidence adduced about the inferiority in which technical colleges stand compared with universities as to salaries and staffing ratio and scholarship provision, seems logically to lead to a demand for full university status for the major colleges of technology. This step, however, Dr. Venables does not take: 'the idea that the university is the sole source of ultimate academic authority' he discounts.

Does he, perhaps, protest too much? At any rate, whatever the final solution, this volume poses the problems in masterly manner.

CYRIL BIBBY

MASTERPIECES OF GREEK DRAWING AND PAINTING. By Ernest Pfuhl, translated by J. D. Beazley. London, Chatto & Windus, 1955. 63s

It is nearly thirty years since Ernest Pfuhl's book was first published. With the passing of time a new interest in Classical art has been awakened. Our approach has broadened. This new edition is therefore specially welcome. The book is what its title suggests—an anthology of masterpieces with a vivid critical commentary which answers just those questions which the pictures raise. While not claiming to be historically exhaustive or scientific, this broad survey reflects deep understanding of the subject.

Professor Pfuhl's introduction starts, as indeed must any true assessment of the Greek genius for art, with form in the round. 'At the mention of Greek art', he says 'everyone thinks first of Greek sculpture'. Greek art is essentially and always a figural art expressing through form and line the ideal of man embodied in the phrase at the entrance to the Delphian Temple of Apollo: 'Know thyself'. It is, in fact, from this basic conception of the significance and supremacy of the human values of Greek sculpture that he proceeds to an examination of the development and interplay

of monumental art and vase painting, and from these to engravings, mosaics, wall paintings, mummy portraits and the rest.

But vase-paintings take up the larger part of the book. Greek vase-painting was restricted in technique and imagery. Like sculpture, 'it was dominated by the figure', and landscape had little or no place in it. Moreover, it was never painting in the modern sense, and therefore bears no comparison with, say, the ceramic painting of Meissen, Sèvres, or Chelsea in the eighteenth century, or for that matter with anything in oriental art. It was always decorative, tectonic, and 'adapted to the special conditions' of the potter's technique, and its development 'led not to painting proper but to pure drawing'.

The quality of that drawing varied in different periods. Professor Pfuhl's introduction and commentary unfold admirably the evolution of vase-painting through its main styles—black-figure, red-figure, and white-ground—to its eventual 'death in beauty'.

One of the most fascinating parts of this book is concerned with the more disputable monumental paintings of the Greeks which are known to us only through wall-paintings of the Roman period. As to how far these may be regarded as reliable copies of earlier Greek pictures, or even to what extent they embody the 'essential features of lost originals', Professor Pfuhl and his translator are at variance. Against Professor Pfuhl's reasonable confidence we should place perhaps Professor Beazley's cautious conclusion that 'the originals must have differed profoundly from these copies or rather imitations'. And yet what power across the ages these imitations possess, that modern artists should be enthralled by them.

The bibliography has been extended and revized by Professor Beazley. There is a list of the artists who painted the Attic vases illustrated, and 160 illustrations, well-chosen and clearly reproduced, including four full-colour plates. Altogether a well-produced and stimulating book.

REGINALD G. HAGGAR

FROM THE JOURNAL OF 1856

VOLUME IV. 9th May, 1856

From a letter On Taking Photographic Images Under Water.

Sir,

I enclose you a positive copy, from a negative collodion plate, of a view of a portion of Weymouth Bay, taken at a depth of three fathoms.

The plan I adopted was very simple.

Mr. Kenyon, of this place, and myself, were weatherbound for a few hours at the Portland Ferry Bridge House, and in a room looking on the Fleet water, that was running like a mill-stream through the bridge, within thirty yards of our window.

I was musing, as persons in our then unfortunate condition (namely, weather-bound, and two miles from home and dinner) will muse; and my thoughts wandered to the effect the great force of the Fleet water would have on the piles of the bridge. I passed in review the piles carried away; and the diver's aid called in to examine the amount of submarine damage, and the difficulties and expense which necessarily follow; and the idea occurred to me that the camera might considerably assist us. . . .

I knew that, could we sink a glass plate, prepared with collodion, to the bottom of the sea, in theory there was no reason why we should not obtain as good an image as we do on land, provided the sea water could be kept from the camera, and that the light was sufficient. . . .

Following my idea, we made a box as nearly watertight as we could, and large enough to enclose the camera.

This box is fitted, in front with a piece of plate glass, and on the outside is a wooden shutter, heavily leaded, and which is raised by a string attached to it and communicating with the boat.

Up to the present point everything has been done on land. We now lash the whole of the apparatus, properly set, to the stern of the boat and, when we arrive at the proper spot, sink the camera. By means of the lowering rope we can find when the camera is upright at the bottom. When satisfied on this point, we raise the shutter in front of the camera box, by means of the string attached to it, and the other end of which communicates with the boat. The camera is now in action. . . .

With all my care, the great pressure at the depth to which I sank my camera forced the water into the camera itself, and covered the collodion plate. When I opened the camera and found it full of water, I despaired of having obtained a view; but it would appear that salt water is not so injurious as I had feared. I took the precaution of washing the plate gently with fresh water, and then of dipping it for an instant in the silver bath. The plate was exposed for ten minutes on an ordinary day in the month of February; it took nearly the same time to develop with pyro-gallic acid, using Horne and Thornwaite's collodion; you will see the negative is a weak one.

This application of photography may prove of incalculable benefit to science. We may take (to a reasonable depth) sketches of submarine rocks, piers of bridges, outlines of sandbanks, in fact, everything that is required under water. Should a pier of a bridge require to be examined, you have to suit your camera, and you will obtain a sketch of the pier, with any dilapidations; and the engineer will thus obtain far better information than he could from any report made by a diver.

WILLIAM THOMPSON

Some Activities of Other Societies and Organizations

MEETINGS

MON. 14 MAY. Chadwick Trust, at the Barnes Hall, Royal Society of Medicine, 1 Wimpole Street, W.1. 5 p.m. Huntington Williams: *The Influence of Chadwick on American Public Health.*

Electrical Engineers, Institution of, Savoy Place, W.C.2. 6 p.m. *An Elementary Presentation of the Principles of Magnetism and Electromagnetic Induction, with demonstration* (Discussion).

Geographical Society, Royal, South Kensington, S.W.7. 5 p.m. J. T. Hollin: *Oxford Expedition to North East Land, 1955.*

TUES. 15 MAY. British Architects, Royal Institution of, at 66 Portland Place, W.1. 6 p.m. Henry Morris: *Architecture and the Local Community.*

Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. T. E. Green: *Mine Locomotives.*

WED. 16 MAY. Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. R. L. Hearn: *The Sir Adam Beck Generating Station No. 2 at Niagara—A Major Canadian Hydro-Electric Development.*

Folk-Lore Society, at University College, Gower Street, W.C.1. 7.30 p.m. T. C. Lethbridge: *The Giants of the Gogmagog Hills.*

THURS. 17 MAY. Textile Institute, at Cardiff University. 7.15 p.m. R. H. Wright: *Modern Textile Designs and their Production.*

WED. 23 MAY. Radio Engineers, British Institution of, at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1. 6.30 p.m. K. Froome: *The Measurement of the Velocity of 'Light' by Electronic Methods.*

FRI. 25 MAY. British Sound Recording Association, at the Royal Society of Arts, W.C.2. 7.15 p.m. H. J. Houlgate: *A Description and Demonstration of the B.B.C. (Type DRD 5) Fine Groove Reproducing Desk, followed by a recital of unusual recordings from the B.B.C. archives presented by T. H. Eckersley.*

OTHER ACTIVITIES

NOW UNTIL 18 MAY. Wood Engravers, Society of, at the Crafts Centre of Great Britain, 16-17 Hay Hill, W.1. *Exhibition of Wood Engravings and Colour Prints.*

NOW UNTIL 25 MAY. The Building Centre, 26 Store Street, W.C.1. *Exhibition of Drawings and Cartoons for Stained Glass Mosaics Tapestries by Einar Forseth.*

NOW UNTIL 26 MAY. Contemporary Arts, Institute of, 17-18 Dover Street, W.1. *Exhibition: Roberto Burle Marx: Brazilian Landscape and Garden Design.*

NOW UNTIL 30 MAY. Imperial Institute, South Kensington, S.W.7. *Exhibition of Current Issues: Commonwealth Postage Stamps.*

MON. 14 MAY UNTIL SUN. 20 MAY. Imperial Institute, South Kensington, S.W.7. 12.30 p.m., 1.15 p.m. and 3 p.m. Weekdays, 3 p.m. and 4 p.m. Saturdays, 3 p.m., 4 p.m. and 5 p.m. Sundays. Films: *Hill Capital—Ceylon; Land of the Buddha—Ceylon.*

WED. 16 MAY. The Building Centre, 26 Store Street, W.C.1. 12.45 p.m. Film Show: *The Tubecright* (an introduction to Tubular Steel Engineering).

MON. 21 MAY UNTIL SUN. 27 MAY. Imperial Institute, South Kensington, S.W.7. 12.30 p.m., 1.15 p.m. and 3 p.m. Weekdays, 3 p.m. and 4 p.m. Saturdays, 3 p.m., 4 p.m. and 5 p.m. Sundays. (Whit Monday—times as for Saturday). Films: *African Journey—South and East Africa; The New India.*